User's Manual

COBHAM

The most important thing we build is trust.

Messenger Portable Decoder

(MPD)

100-M0081X1
05/18/09

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1 Introduction

Messenger Portable Decoder (MPD)
MPEG-2 Digital Audio/Video Decoder

MPD

MPD with MSR Mounted

Key Features

- Broadcast Quality 4:2:2 MPEG-2 Decoder
- Low Delay
- Compact Design
- Designed to mate with MSR
- Runs on 12VDC

The GMS Messenger Portable Decoder (MPD) is a compact professional 4:2:2 MPEG-2 digital audio/video decoder that is designed to be a companion to GMS' MSR Diversity Receiver. A mounting plate is provided that allows the MSR to be mounted on top of the MPD. Two fans in the MPD provide cooling for both the MPD and the MSR. The ASI output of the MSR is feed into the MPD, which receives the MPEG2 TS stream, decodes it and output signals via analog video/audio ports, SDI/AES ports. These units can be controlled via either the RS-232C or USB control ports. An optional 19-inch Rack-Mounted shelf is available that can mount up to two MPD/MSR in just 5.25" of rack space. Additionally, an optional in-line AC/DC power supply is available.
When used in conjunction with GMS' MDT-B transmitter and MSR receiver, system latencies down to 2-3 frames are provided. The combination of Broadcast Quality Audio/Video and ultra-low latency make this system perfect for sports and ENG applications!

2 Technical Specifications

Audio/Video Decoding

Support ISO13818-1 TS demultiplexing (up to 32PID)
Support ISO13818-2 (Main Profile @ Main Level and 422 Profile @ Main Level) video decoding
Support ISO11172-3 and ISO13818-3 audio decoding, provide simultaneous 2 pairs of stereo (4 channels) decoding
Support graphic display up to 16 bits/pel (OSD)

Transport Stream

Input
Type: DVB-ASI via BNC-F (Rear Panel)
Rate: 1 b/Sec to 213 Mb/Sec
TS Demultiplexing: In accordance with ISO13818-1 with up to 32 PIDs.

Output
Type: DVB-ASI loop via BNC-F (Rear Panel)
Rate: 1 b/Sec to 213 Mb/Sec

Video Decoding
Type: MPEG-2
Standard: Supports ISO13818-2
Profiles: Main Profile @ Main Level, Simple Profile @ Main Level and
422 Profile @ Main Level
Decoding Rates: 4:2:2 P@ML(1.5-50MHz)
4:2:0 MP@ML(1.5-15MHz)
4:2:0 SP@ML(1.5-15MHz)
GOP Length: From adapt to input TS

Video Outputs

Analog Video
Interface: Qty 2 CVBS w/OSD (Rear – BNC-F, Front – BNC-F)
Video Format: PAL-B/G/I/M/N/D, NTSC, and SECAM L/B/G/K1
Screen Proportion: 4:3/16:9
Graphic Process: OSD,
Support graphic display up to 16 bits/pel (OSD)
Synchronization Information (Via DB-9M on rear panel)
Video Synchronous Output SYNC Synchronous line/field/frame output
Synchronous lock output
27M reference clock output

Audio Outputs
Analog Audio: 2 channels stereo, balanced via XLR-M on rear panel
2 channels stereo, un-balanced via RCA-F on front panel
Digital Audio: 1 channel of AES/EBU-SPDIF via BNC-F on rear panel

Status Indicators (Front Panel)
LEDs: On/Standby, Decoder Lock Status, ASI Signal Present

Control
RS-232C via DB-9M on rear panel
USB-1 via USB-Type A on rear panel
Software: MS Windows Graphical User Interface Application
(Windows 2000 & XP compatible.)

Electrical Features
Power Supply: 9 to 17 VDC (External In-Line AC PWR Supply Optional)
Power Consumption: < 45W
Pin1 and Pin 6 (9-17VDC)
Pin 5 and Pin 9 (GND)

Physical
Dimensions: 8.5" (W) x 8.5" (D) x 1.0" (H)
21.6 cm x 21.6 cm x 2.54 cm
Weight: 3.65 lbs (1.656 kg)

Environmental Conditions
Operating Temperature: 0° C ~50° C
Storage Temperature: -20° C ~80° C
Comparative Humidity: 10% ~ 90%, non-condensing

Digital Video
Interface: Qty 1 - SDI via BNC-F

Audio Decoding
Standard: Supports ISO11172-3 and ISO13818-3 audio decoding
Number of Outputs: simultaneous 2 pairs of stereo (4 channels) decoding

Audio Outputs
Analog Audio: 2 channels stereo, balanced via XLR-M on rear panel
2 channels stereo, un-balanced via RCA-F on front panel
Digital Audio: 1 channel of AES/EBU-SPDIF via BNC-F on rear panel

Status Indicators (Front Panel)
LEDs: On/Standby, Decoder Lock Status, ASI Signal Present

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Environmental Conditions

Operating Temperature: 0° C ~50° C
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Comparative Humidity: 10% ~ 90%, non-condensing

3 MPD Local Control

3.1 MPD Controls, Indicators and Connectors

3.1.1 Panels and Keys

Front Panel:

Where:

POWER	:Power Switch
PWR	:Power On/Standby Indication
TS	:ASI Signal Present Status
LOCK	:Decoder Lock Status
1/R	:Analog Audio Signal /Channel 1 /Right
1/L	:Analog Audio Signal /Channel 1 /Left
1/CVBS	:Composite Video Broadcast Signal, Channel 1

Rear Panel:

Where;

ASI IN	:Asynchronous Serial Interface Signal Input
ASI OUT	:Asynchronous Serial Interface Signal Output
SDI	:Serial Digital Interface Digital Video Output
AES	:Advanced Encryption Standard digital Audio Output
2/CVBS	:Composite Video Broadcast Signal, Channel 2
2/R	:Analog Audio Signal /Channel 2 /Right
2/L	:Analog Audio Signal /Channel 2 /Left
CTRL1	:RS232 Interface
CTRL2	:USB Interface
POWER	:DC Power Line

MPD has three status indicators and analog A/V output interfaces on the front panel, and various interfaces on the rear panel. There are power switch, power/standby, TS and Lock indication LEDs and analog A/V output interfaces of channel 1 on the front panel. There is a pair of DVB ASI interfaces on the rear panel for receiving MPEG-2 TS and loop back. The rear panel provides analog A/V output interfaces of channel 2 and digital A/V interface. RS232 interface on the rear panel is for upgrading micro-code and sending out test signal comprised 27 MHz clock and h/v sync. . All kinds of local control and operation can be executed through RS232 or USB interface.

3.2 Operating Instructions – local

For single-program Transport Streams (TSs), like those that are typically output from GMS' Wireless Audio/Video Links, the Messenger Portable Decoder (MPD) is a plug & play device. It will automatically select and decode any compliant compressed Video or Audio and provide uncompressed outputs. With the OSD function turned-off, the user can monitor status via the MPD's Front Panel LEDs. With the OSD function turned on, the video output provides additional information on the incoming stream. See Section 3.2.2. The OSD function and all other MPD controls can be controlled using the MPD M.S. Windows Control Panel Software. See Section 4.

3.2.1 Standalone Operation without OSD

Before activating MPD, please carefully check all the cable connections and ensure that the appropriate power supply voltage (+12 VDC) is applied to the unit. Connection between RS232 or USB interface and PC is not necessary, which is generally used when micro-code is to be updated and operational parameters need to be set by remote control application.

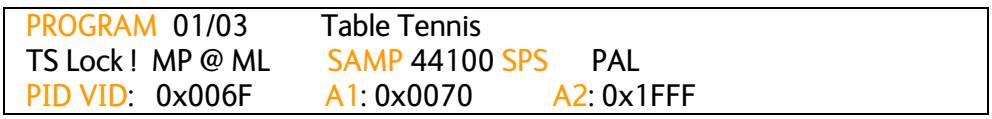
Once power is on, MPD begins its self-examination and initialization, which may take a few seconds. At this time, the monitor displays blue screen. It is normal even if the screen jitters a little. As initialization and self-examination finish, MPD will setup initial parameters from flash and check the status of ASI input port. Should relevant unit and TS parameter setting turn out correct, both image and sound will be shown. Otherwise, black screen appears and the MPDs PID analysis operations will be run until a properly formatted TS is supplied to the MPD's ASI input

3.2.2 Standalone Operation with OSD

Before activating MPD, please carefully check all the cable connections and ensure that the appropriate power supply voltage (+12 VDC) is applied to the unit. Connection between RS232 or USB interface and PC is not necessary, which is generally used when micro-code is to be updated and operational parameters need to be set by remote control application.

The MPD has a clear-cut and automatic OSD display. Users will easily find out operation information according to the decoder.

OSD Screen structure is given as:



The working status of MPD is determined by input TS signal from ASI interface. As MPD is powered-on for the first time, the system will automatically pick up original set-up parameters and examine the input TS. Users can modify the original set-up parameters to get a new set of parameters using the M.S. Windows Remote Control Software. See Section 4. As MPD is powered on next time, the system will pick up the user's parameters. Users, of course, can either recover original parameters or re-modify the parameters.

Once power is on, MPD begins its self-examination and initialization, which may take a few seconds. At this time, the monitor displays blue screen. It is normal even if the screen jitters a little. As initialization and self-examination finish, MPD will setup initial parameters from flash and check the status of ASI input port. Should relevant parameter setting turn out correct and ASI connects ready, both image and sound will be shown. Otherwise, black screen appears and PID analysis operations need to be run under background.

PID searching:

MPD has PID searching function. MPD will go to the following operations:

1) Check ASI input signal
2) Set PID filters and get PAT and PMT information
3) Set A/V decoder parameters. If PID searching turns out all right, A/V signal will be played. The results of PID searching and other mode information are given as:

```
PROGRAM  01/03        Table Tennis
TS Lock !  MP @ ML     SAMP 44100 SPS     PAL
PID VID:   0x006F      A1: 0x0070         A2: 0x1FFF
```

Where:

PROGRAM 01/03 :display the number of program streams found in the Transport Stream. The first program will be decoded automatically.

Table Tennis :display the service_id information defined in the SDT.

TS Lock ! :ASI link is stable, otherwise display No TS message

MP @ ML :main profile @ main level / 422 profile @ main level

SAMP 44100 SPS :audio sample ratio 44.1k/48k/32k

PAL :Video mode PAL/NTSC

PID VID: 0x006F :video PID, Video signal output from front and rear panel have same PID

A1: 0x0070 :audio PID. Audio 1 always output from front panel.

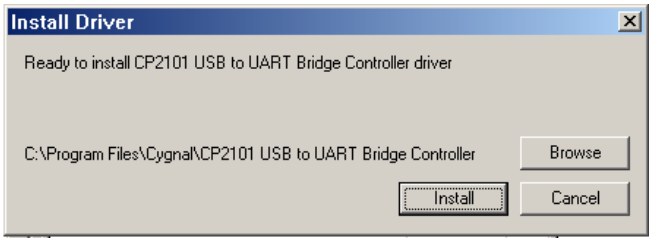
A2: 0x1FFF :audio PID. Audio 2 always output from rear panel.

*A/V PID value can be manually set by M.S. Windows Control Application as well. MPD will retain new parameters after change.

4 Remote Operation

4.1 USB Driver Installation

Find pre-install USB drivers file under \..\current_driver\setup.exe
Run setup.exe.
This operation will install pre-install software V1.16 to your PC.



Press “Install”, then wait till the install process finishes.

After finishing pre-install driver, user can connect USB cable to MPD. This time new message windows will pop up. OS finds a new hardware.

Wait for OS to close all message windows.
After completely install USB driver, user can configure USB to UART port as your wish

4.2 MPD Windows Control Panel Software

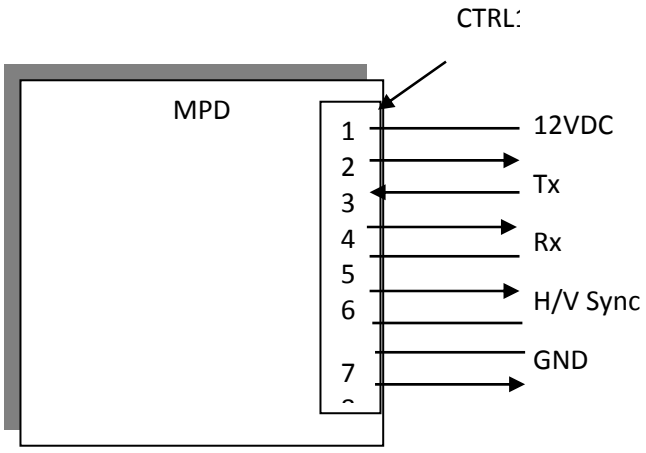
MPD Control panel software is only a demo program for MPD serial port communication protocol.

System Requirements:

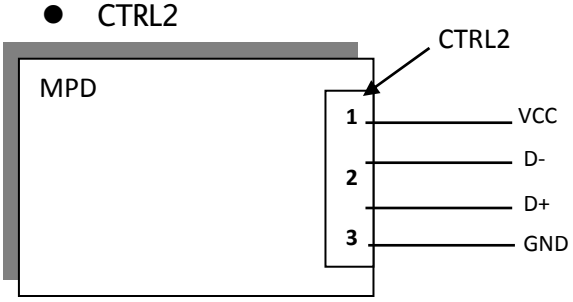
- PC with free ASC0 channel or free USB channel
- Windows 95 and above, Windows NT 4.0 and above
- One serial cable or USB cable

Cable Pinout Definition:

- CTRL1



- CTRL2



Cable Connection:

Directly connect between MPD CTRL1 port and PC COM port (RS232) OR
Directly connect between MPD CTRL2 port and PC USB port

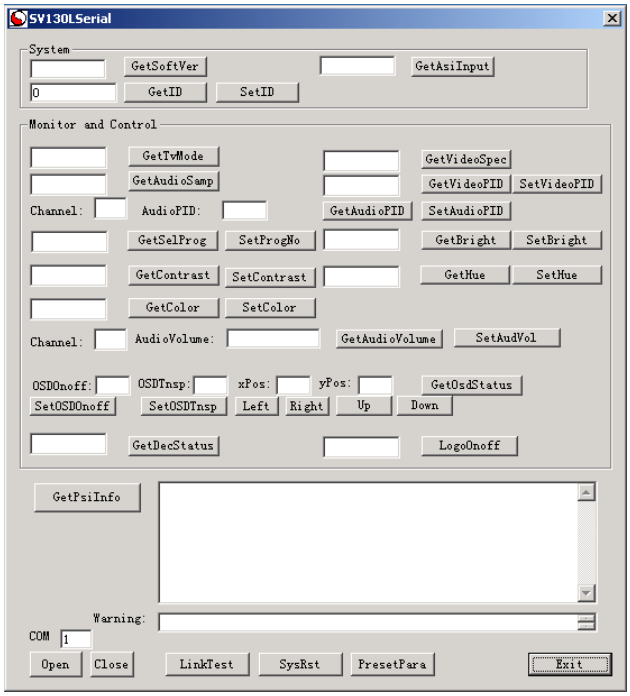
Getting Started:

Using CTRL1

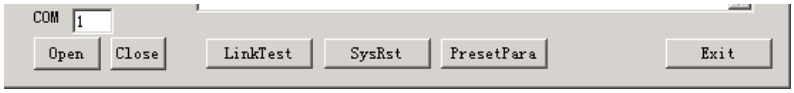
Connect serial cable
Power on MPD and execute MPD control panel

Using CTRL2

Install USB driver, a virtual COM port is available (Please refer to USB driver user manual for detail)
Find the virtual COM port No.
Connect USB cable.
Power on MPD and execute MPD control panel.


SV130LSerial
System
GetSoftVer
GetAsiInput
0
GetID
SetID
Monitor and Control
GetTvMode
GetVideoSpec
GetAudioSamp
GetVideoPID
SetVideoPID
Channel:
AudioPID:
GetAudioPID
SetAudioPID
GetSelProg
SetProgNo
GetBright
SetBright
GetContrast
SetContrast
GetHue
SetHue
GetColor
SetColor
Channel:
AudioVolume:
GetAudioVolume
SetAudVol
OSDOnoff:
OSDTnsp:
xPos:
yPos:
GetOsdStatus
SetOSDOnoff
SetOSDTnsp
Left
Right
Up
Down
GetDecStatus
LogoOnoff
GetPsiInfo
Warning:
COM
1
Open
Close
LinkTest
SysRst
PresetPara
Exit

Open COM port and press "Open" button. E.g. if COM 1 is connected with CTRL0, fill 1 at COM item, "Open" it, you can control MPD using serial port. If COM 3 is connected with CTRL2, fill 3 at COM item, "Open" it, you can control MPD using USB port. Open a corresponding port first when you execute this control panel.

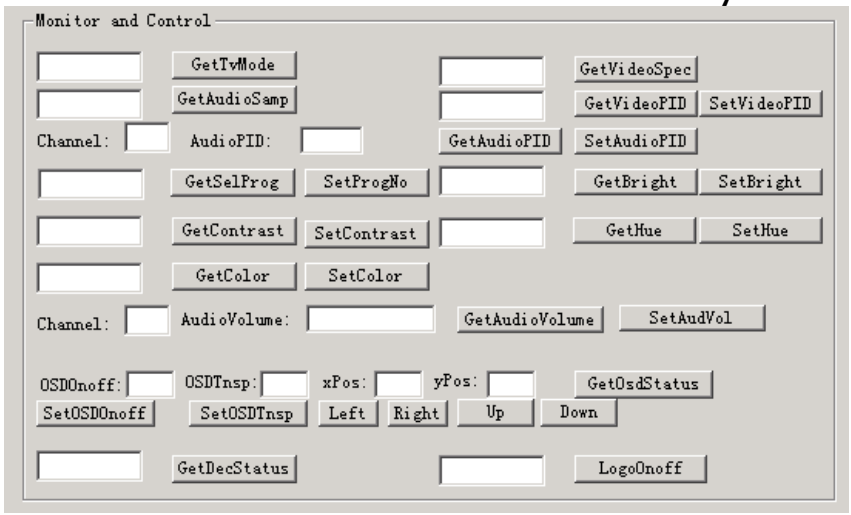


"LinkTest": Test the serial port connection between Host and MPD.
"SysRst": Reset on MPD
When you press this button, MPD needs around 20 seconds to initialize.
"PresetPara" Restore default parameters.
When you press this button, it will cause the re-start of MPD system.

System Table

"GetSoftVer": Read MPD software version number
"GetAsiInput" Read the TS status of MPD ASI input. It is a decimal value.
value.0: 1 --- with TS input; 0 --- without TS.
value.1: 1 --- TS abnormal; 0 --- TS normal.
value.2: 1 --- TS lock; 0 --- TS unlock.
value.3 – value.7 is fixed 0
e.g. if the value = 5 means the input TS stream is normal and locked.
"GetID" Get the ID number of the currently connected MPD.
Note: you must fill 0 at blank item and press the "GetID" button, you can get correct ID value.
"SetID" Set new ID number for the currently connected MPD.
Fill the new ID number, press the "SetID" button.

Monitor and Control Table **Get MPD System Information.**



"GetTvMode"	Read the current video output mode. 0 means NTSC 1 means PAL 2 means SECAM
"GetVideoSpec"	Read the current video syntax subset and level. 0 means MainProfile @ Main Level 1 means 4:2:2 Profile @ Main Level
"GetAudioSamp"	Read current audio sampling rate. As MPD's two audio channels can only work on the same sampling rate, so the reads apply to both of the audio channels at the same time. 0 means 48k/s 1 means 44.1K/s 2 means 32K/s
"GetVideoPID"	Read current video PID.
"SetVideoPID"	Set current video PID. e.g. fill 0x01C2 at the left blank item and press the "SetVIdeoPID" button. It means that the VideoPID is set as 0x01C2.
"GetSelProg"	Read the program number of the current program being played. e.g. 1 means Program 1 is playing.
"SetSelProg"	Set the number of program which is playing. e.g. fill 3 at the left blank item and press the "SetSelProg" button. It means Channel 3 program is playing.
"GetBright"	Read the brightness of current analog video output.
"SetBright"	Set the brightness of current analog video output. e.g. fill 55 at the left blank item and press the "SetBright" button. It means Bright=55. 0<=Bright<=100 is available.
"GetContrast"	Read the contrast of current analog video output.
"SetContrast"	Set the contrast of current analog video output. e.g. fill 55 means Contrast=55. 0<=Contrast<=100 is available.
"GetHue"	Read the hue of current analog video output.
"SetHue"	Set the hue of current analog video output. e.g. fill 55 means Hue=55. 0<=Hue<=100 is available.
"GetColor"	Read the color of current analog video output.
"SetColor"	Set the color of current analog video output. e.g. fill 55 means Color=55. 0<=Color<=100 is available.
"GetAudioPID"	Read PID of audio channel 1 and audio channel 2. Fill 0 at "Channel:" item and press "GetAudioPID", you can get PID of audio channel 1. Fill 1 at "Channel:" item and press "GetAudioPID", you can get PID of audio channel 2. Except for 0 and 1, the others are invalid.
"SetAudioPID"	Set PID of audio channel 1 and audio channel 2. e.g. fill 0 at "Channel:" item and fill 0x01C2 at "AudioPID" item, then press "SetAudioPID". It means set Audio channel 1 PID = 0x01C2. Fill 1 at "Channel:" item and fill 0x01C2 at "AudioPID" item, then press "SetAudioPID", It means set Audio channel 2 PID = 0x01C2.
"GetAudioVolume"	Read the volume of audio channel 1 and audio channel 2. Fill 0 at "Channel:" item and press "GetAudioVolume", you can get PID of audio channel 1.

	Fill 1 at “Channel:” item and press “GetAudioVolume”, you can get PID of audio channel 2. Except for 0 and 1, the others are invalid.
“SetAudVol”	Set the volume of audio channel 1 and audio channel 2. e.g. fill 0 at “Channel:” item and fill 55 at “AudioVolume” item, then press “SetAudVol”. It means set Audio channel 1 volume = 55. Fill 1 at “Channel:” item and fill 55 at “AudioVolume” item, then press “SetAudVol”, It means set Audio channel 2 volume = 55 .
“GetOsdStatus”	Read current OSD status. “OSDOnOff:” = 1, means OSD is close; “OSDOnOff:” = 0, means OSD is open; “OSDTnsp:” =0, means OSD transparency is 0%; “OSDTnsp:” =1, means OSD transparency is 25%; “OSDTnsp:” =2, means OSD transparency is 50%; “OSDTnsp:” =3, means OSD transparency is 75%; “xPos:” represents the horizontal position of the OSD window. 0<=xPos<=80 is available. “yPos:” represents the vertical position of the OSD window. 0<=yPos<=40 is available.
“SetOSDOnOff”	Open or close OSD Fill 0 at “OSDOnOff” item and press “SetOSDOnOff” button. It means that OSD is open. Fill 1 at “OSDOnOff” item and press “SetOSDOnOff” button. It means that OSD is close. Fill 2 at “OSDOnOff” item and press “SetOSDOnOff” button. It means that OSD is in auto-matic mode. When MPD finds some info change, it automatically opens OSD, and displays the change info on the OSD. When the info keeps stable for about 10 seconds, the OSD is then automatically closed.
“SetOSDTnsp”	Set up OSD transparency. Fill 0 at “OSDTnsp” item and press “SetOSDTnsp” button. Set OSD transparency as 0%. Fill 1 at “OSDTnsp” item and press “SetOSDTnsp” button. Set OSD transparency as 20%. Fill 2 at “OSDTnsp” item and press “SetOSDTnsp” button. Set OSD transparency as 40%. Fill 3 at “OSDTnsp” item and press “SetOSDTnsp” button. Set OSD transparency as 60%. Fill 4 at “OSDTnsp” item and press “SetOSDTnsp” button. Set OSD transparency as 80%. This command will keep OSD and LOGO of MPD in open status.
“Left” “Right”	Set up OSD horizontal position. Press “Left” button, means to horizontally move the OSD window to the left (2 pixels) . Press “Right” button, means to horizontally move the OSD window to the right (2 pixels) .

"Up" "Down"	Set up OSD vertical position. Press "Up" button, means to vertically move the OSD window upward (2 pixels) . Press "Down" button, means to vertically move the OSD window downward (2 pixels) .
GetPsiInfo	Get TS Stream PSI Information. Press "GetPsiInfo" to read PSI information of current bit stream. Please refer to "MPD Serial Port Communication Protocol" for details.

4.3 MPD Serial Port Communication Protocol

MPD MPEG-2 Decoder has one RS232 serial port and one USB interface. The external equipment (usually PC or Host) can achieve the monitoring and control on the working status of MPD, which makes it easy for the applications such as secondary development, production test, engineering commissioning and operation maintenance, etc.

This file consists of the following parts:

- MPD serial port communication mode (equivalent to physical layer);
- Protocol format of the serial port communication between MPD and monitoring program;
- Handshake acknowledge time order of MPD serial port communication;
- Host monitoring program: the host can monitor the operation status and execute control on MPD by the monitoring program.

Serial Port Communication Mode

Serial Port Communication Mode is as follows:

Serial Port Communication Mode

Serial Port Communication Mode	Parameters
Start	1 bit
Stop	1 bit
Data	8 bits
Odd-even check	No
Baud Rate	38400bps
Flow Control	**No (Normal Mode)**

4.3.1 Protocol Format

Data Frame Format

Data Frame Format includes Command Format, Acknowledge Format and Warning Format. Command Format is the command data format that the host monitoring program sends to MPD; Acknowledge Format is data format that MPD acknowledges the host monitoring program; Warning Format is warning information that MPD initiatively submit to the host monitoring program.

Command Format

SYNH	ID	LENH	LENL	CMD	DATA	SUM	SYNE
1B	2B	1B	1B	1B	(LENH/LENL)B	1B	1B
0xAA	ID number of the connected MPD	Length of (CMD+DATA) In unit of Byte		Command Code	N Bytes of optional DATA	Sum of (ID,LENH, LENL,CMD,DATA)	0x55

Acknowledge Format

SYNH	ID	LENH	LENL	ACK	DATA	SUM	SYNE
1B	2B	1B	1B	1B	(LENH/LENL)B	1B	1B
0xAA	ID number of the MPD	Length of (ACK+DATA) In unit of Byte		Acknowledge Code	N Bytes of optional DATA	Sum of (ID,LENH, LENL,ACK,DATA)	0x55

Warning Format

SYNH	ID	LENH	LENL	WARN	DATA	SUM	SYNE
1B	2B	1B	1B	1B	4B or 1B	1B	1B
0xAA	ID number of the MPD	Length of (WARN+DATA), In unit of Byte		Warning Code 0x11	4 or 1 bytes of DATA	Sum of (ID,LENH, LENL,WARN,DATA)	0x55

Definition of Data Segment

Data Segment	Definition and Explanation	
SYNH	Sync. flag is 0xAA.	
ID	ID number for each MPD. The monitoring program should use the right ID number to communicate with the corresponding MPD. ID=0x0000 refers to one reserved ID, and the monitoring program can use ID=0x0000 to communicate with any one of MPD.	
LENH	Data length high byte	**LENH** and **LENL** form one 16bit unsign integer. It represents the DATA length, the unit is in byte. When there is no data, the value is 0.
LENL	Data length low byte	
CMD	Command code, which refers to the command that the monitoring program sends to MPD.	
ACK	Acknowledge code, which refers to the acknowledge that MPD sends to the monitoring program. When the command is successfully executed, ACK=CMD, or otherwise, ACK=0x00.	
WARN	Warning code, which refers to the warning that MPD initiatively sends to the monitoring program. Its value is always 0x11.	
DATA	In Command or Acknowledge frame, it is an optional item, and its length is changeable. In Warning frame, it shows 4 or 1 byte warning information.	
SUM	Check summary , which is the byte summary of LENH, LENL, CMD/ACK, DATA, carry omitted.	
SYNE	Sync. End, total is 0x55.	

The range of DATA length value is 0~2040. When DATA length is 2040, (LENH/LENL)= 0x07F8. The whole data frame length at this time happens to be 2048B (1B SYNH + 2B ID + 2B LENH/LENL + 1B CMD/ACK + 2040B DATA + 1B SUM + 1B SYNE).

4.3.2 Command, Acknowledge and Warning

The command and acknowledge of MPD include the following three operations: System operation, Monitor operation, Control operation. In addition, MPD has the function of automatic alarming.

System Operation

System Operation

Note: DATC[X] represents command data, DATA[X] represents acknowledge data

System Operation	Command		Acknowledge		Explanations
	CMD	DATA	ACK	DATA	
LinkTest	0xFF	None	0xFF	None	Test the serial port connection between Host and MPD. 1) Before sending out other commands, Host should first send LinkTest command to make sure that the serial port communication is working fine. 2) Host can also periodically send out this test command to execute the real-time monitoring on the serial port connection status.
SoftVer	0xFE	None	0xFE	DATA[0..1]	Read MPD software version number. 1) In Acknowledge frame, DATA[0] is the integer part of the version number, and DATA[1] is the decimal part of the version number. E.g. when DATA[0]=0x02, DATA[0]=0x04, this means the software version number is Ver2.4.
SysRst	0xFD	None	0xFD	None	Reset on MPD 1) When Host sends out this command and receives the acknowledge frame of MPD, it only means that MPD has received the SysRst command, and it does not mean the reset has done. It usually takes around 20 seconds for MPD to initialize; 2) Host should then send out several LinkTest commands until it receives the LinkTest acknowledge from MPD, which means that MPD has completed the reset.

AsiInput	0xFC	None	0xFC	DATA[0]	Read the TS status of MPD ASI input. In acknowledge frame, 1) DATA[0].0: 1, with TS input; 0, without TS. 2) DATA[0].1: 1, TS abnormal; 0, TS normal. 3) DATA[0].2: 1, TS lock; 0, TS unlock.
GetID	0xFB	None	0xFB	None	Get the ID number of the currently connected MPD的ID. 1) In command frame, ID=0x0000; 2) In acknowledge frame, ID=ID number of the currently connected MPD.
SetID	0xFA	DATC[0..1]	0xFC	DATA[0..1]	Set new ID number for the currently connected MPD. 1) The ID in command frame is the old ID or is 0x0000; 2) DATC[0..1]=NewID,e.g. when DATC[0]=0x12, DATC[0]=0x34, it means NewID=0x1234; 3) The ID in acknowledge frame is the old ID number; 4) DATA[0..1]=NewID, e.g. when DATA[0]=0x12, DATC[0]=0x34, it means NewID=0x1234; 5) When the SetID command is successfully executed, the monitoring program should use NewID or 0x0000 as the ID number to communicate with the corresponding MPD.

Monitor Operation

Monitor Operation

Note: DATC[X] represents Command Data, DATA[X] represents Acknowledge Data

Monitor Operation	Command		Acknowledge		Explanation
	CMD	DATA	ACK	DATA	
TvMode	0xEF	None	0xEF	DATA[0]	Read the current video output mode. 1) DATA[0]=0x00 NTSC 2) DATA[0]=0x01 PAL 3) DATA[0]=0x02 SECAM
VideoSpec	0xEE	None	0xEE	DATA[0]	Read the current video syntax subset and level. 1) DATA[0]=0x00 Main Profile @ Main Level 2) DATA[0]=0x01 4:2:2 Profile @ Main Level

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AudioSamp	0xED	None	0xED	DATA[0]	Read current audio sampling rate. As MPD's two audio channels can only work on the same sampling rate, so the reads apply to both of the audio channels at the same time. 1) DATA[0]=0x00 48000k/s 2) DATA[0]=0x01 44100k/s 3) DATA[0]=0x02 32000k/s
VideoPID	0xEC	None	0xEC	DATA[0..1]	Read current video PID. 1) DATA[0..1] = VideoPID, little endian; e.g. when DATA[0]=0x01, DATA[1]=0xC2, it means VideoPID = 0x01C2.
Audio0PID	0xEB	DATC[0]	0xEB	DATA[0] DATA[1..2]	Read PID of current audio channel 0. Audio channel 0 is output from the front panel. 1) DATC[0]=0x00 represents channel 0; 2) DATA[0]=0x00 represents channel 0; 3) DATA[1..2]=Audio1PID, little endian; e.g. when DATA[1]=0x02, DATA[2]=0xC2, it means Audio0PID = 0x02C2.
Audio1PID	0xEB	DATC[0]	0xEB	DATA[0] DATA[1..2]	Read PID of current audio channel 1. Audio channel 1 is output from the rear panel. 1) DATC[0]=0x01, represents channel 1; 2) DATA[0]=0x01, represents channel 1; 3) DATA[1..2]=Audio1PID, little endian; e.g. when DATA[1]=0x02, DATA[2]=0xC3, it means Audio1PID = 0x02C3.
SelProg	0xEA	None	0xEA	DATA[0..1]	Read the program number of the current program being played. 1) DATA[0..1]=ProgNumber, little endian; e.g. when DATA[0]=0x00, DATA[1]=0x01, it means Program 1 is playing; when DATA[0]=0x00, DATA[1]=0x10, it means program 16 is playing; when DATA[0]=0x00, DATA[1]=0x00, it means no program is currently playing.
Bright	0xE9	None	0xE9	DATA[0]	Read the brightness of current analog video output. 1) DATA [0]=Bright, 0<=Bright<=100, e.g. when DATA[0]=0x37, it means Bright=55.
Contrast	0xE8	None	0xE8	DATA[0]	Read the contrast of current analog video output. 1) DATA[0]=Contrast, 0<=Contrast <=100, e.g. when DATA[0]=0x37, it means Contrast=55.
Hue	0xE7	None	0xE7	DATA[0]	Read the hue of current analog video output. 1) DATA[0]=Hue, 0<= Hue <=100, e.g. when DATA[0]=0x37, it means Hue =55.

Color	0xE6	None	0xE6	DATA[0]	Read the color saturation of current analog video output. 1) DATA[0]= Color, 0<= Color <=100, e.g.DATA[0]=0x37, it means Color=55.
Audio0Volume	0xE5	DATC[0]	0xE5	DATA[0] DATA[1]	Read the volume of current audio channel 0. Audio channel 0 is output from the front panel. 1) DATC[0]=0x00, represents channel 0; 2) DATA[0]=0x00, represents channel 0; 3) DATA[1]=Audio0Volume, 0<= Audio0Volume <=100, e.g. when DATA[1]=0x37, it means Audio0Volume =55.
Audio1Volume	0xE5	DATC[0]	0xE5	DATA[0] DATA[1]	Read the volume of current audio channel 1. Audio channel 1 is output from the rear panel. 1) DATC[0]=0x01, represents channel 1; 2) DATA[0]=0x01, represents channel 1; 3) DATA[1]=Audio1Volume, 0<= Audio1Volume <=100, e.g. when DATA[1]=0x37, it means Audio0Volume =55.
OsdStatus	0xE4	None	0xE5	DATA[0] DATA[1] DATA[2] DATA[3]	Read current OSD status. 1) DATA[0]=0x00, means OSD is closed; DATA[0]=0x01, means OSD is open. 2) DATA[1]=0x00, OSD transparency is 0%; DATA[1]=0x01, OSD transparency is 25%; DATA[1]=0x02, OSD transparency is 50%; DATA[1]=0x03, OSD transparency is 75%; 3) DATA[2]=xPos, represents the horizontal position of the OSD window, 0<=xPos<=80; e.g. when DATA[2]=0x20, it means xPos=32; 4) DATA[3]=yPos, represents the vertical position of OSD window, 0<=yPos<=40; e.g. when DATA[3]=0x20, it means yPos=32.
DecStatus	0xE3	None	0xE4	DATA[0]	Read the current decode status. DATA[0].X represents the X digit of DATA[0]. 1) DATA[0].0=1, means the video decode channel is working, DATA[0].0=0, means video decode channel is closed; 2) DATA[0].1=1, means audio channel 0 is working, DATA[0].1=0, means audio channel 0 is closed; 3) DATA[0].2=1, means audio channel 1 is working, DATA[0].2=0 means audio channel 1 is closed; e.g. when DATA[0]=0x05, DATA[0].0=1, DATA[0].1=0, DATA[0].2=1, it means video channel and audio channel 1 is working, and video channel 0 is closed.

PsiInfo	0xE2	None	0xE3	DATA[0..N]	Read PSI information of current bit stream. For the definition of DATA[0..N], please refer to the following **Get MPEG-2 Program Specs Information**

Get MPEG-2 Program Specs Information

Format of DATA[0..N].

Program Specs Information		
DATA[0..N] Syntax	**No. Byte**	**Data Type**
MPEG2_PSI()		
TransportStreamId	2B	little endian, INT16U
TotalProgramNumber	2B	little endian, INT16U
For (I=0; I< ProgramNumber; I++)		
PmtID	2B	little endian, INT16U
PmtPid	2B	little endian, INT16U
PcrPid	2B	little endian, INT16U
PidNum	2B	little endian, INT16U
For(j=0; J< PidNum; J++)		
PID	2B	little endian, INT16U
Type	2B	little endian, INT16U
ProviderName	20B	Char *
ProgramName	20B	Char *

TransportStreamId - ID number of transport steam which is in PAT[1].
TotalProgramNumber - The total program numbers in the current transport stream.
PmtID - The current program number, which represents channel PmtID program of TS. It is in PAT.
PmtPid - PID number of current program mapping table (PMT).
PcrPid - PID number of current program clock reference(PCR).
PidNum - The numbers of Elementary Stream in the current program, or the numbers of PID (when independent PcrPID is not used).
PID - PID of elementary stream(ES).
Type – The type of the elementary stream, e.g. audio or video. The definition of the Type complies with ISO/IEC 13818-1:

Type Value	Type
0x0000	ITU-T	ISO/IEC reserved
0x0001	ISO/IEC 11172-2 Video
0x0002	ISO/IEC 13818-2 Video or ISO/IEC 11172-2 constrained parameter video stream
0x0003	ISO/IEC 11172-3 Audio
0x0004	ISO/IEC 13818-3 Audio
0x0005	ITU-T Rec. H.222.0	ISO/IEC 13818-1 private_sections
0x0006	ITU-T Rec. H.222.0	ISO/IEC 13818-1 PES packets containing private data
0x0007	ISO/IEC 13522 MHEG
0x0008	Annex A – DSM CC
0x0009	ITU-T Rec. H.222.1
0x000A	ISO/IEC 13818-6 type A
0x000B	ISO/IEC 13818-6 type B
0x000C	ISO/IEC 13818-6 type C

[1] Refer to ISO/IEC 13818-1

0x000D ISO/IEC 13818-6 type D
0x000E ISO/IEC 13818-1 auxiliary
0x000F-0x007F ITU-T Rec. H.222.0 | ISO/IEC 13818-1 reserved
0x0080-0x00FF User private

ProviderName - is a character string with fixed length (20B) in which the name of the program provider is stored. When the length of provider name is less than 20B, the rest characters are filled up with 0. It is stored in SDT[2].

ProgramName - is a character string with fixed length (20B) in which the name of the program is stored. When the length of the program name is less than 20B, the rest characters are filled up with 0. It is stored in SDT.

Control Operation

Note: DATC[X] represents command data, DATA[X] represents acknowledge data

Control Operation	Command		Acknowledge		Explanation
	CMD	DATA	ACK	DATA	
SetVidPID	0xCF	DATC[0..1]	0xCF	None	Set up current video PID. 1) DATC[0..1] = VideoPID, e.g. when DATC[0]=0x01, DATC[1]=0xC2, it means that the VideoPID is set as 0x01C2.
SetAud0PID	0xCE	DATC[0] DATC[1..2]	0xCE	DATA[0]	Set up PID of current audio channel 0. 1) DATC[0]=0x00, represents channel 0; 2) DATA[0]=0x00, represents channel 0; 3) DATC[1..2]=Audio0PID, e.g. when DATC[1]=0x01, DATC[2]=0xC3, it means Audio0PID = 0x01C3.
SetAud1PID	0xCE	DATC[0] DATC[1..2]	0xCE	DATA[0]	Set up PID of current audio channel 1. 1) DATC[0]=0x01, represents channel 1; 2) DATA[0]=0x01, represents channel 1; 3) DATC[1..2]=Audio1PID, e.g. when DATC[1]=0x01, DATC[2]=0xC4, it means Audio1PID = 0x01C4.
SetProgNo	0xCD	DATC[1..2]	0xCD	None	Set up the number of program which is playing. 1) DATC[0..1]=ProgNumber, e.g. when DATC[0]=0x00, DATA[1]=0x00, it means Channel 0 program is playing; when DATA[0]=0x00, DATA[1]=0x10, it means Channel 16 program is playing.
SetBright	0xCC	DATC[0]	0xCC	None	Set up the brightness of current analog video output. 1) DATC [0]=Bright, 0<=Bright<=100, e.g. when DATC[0]=0x37, it means Bright=55.
SetContrast	0xCB	DATC[0]	0xCB	None	Set up the contrast of current analog video output. 1) DATC[0]=Contrast, 0<=Contrast <=100, e.g. when DATC[0]=0x37, it means Contrast=55.

[2] DVB EN 300 468

SetHue	0xCA	DATC[0]	0xCA	None	Set up the hue of current analog video output. 1) DATC[0]=Hue, 0<= Hue <=100, e.g. when DATC[0]=0x37, it means Hue =55.
SetColor	0xC9	DATC[0]	0xC9	None	Set up the color saturation of current analog video output. 1)DATC[0]= Color, 0<= Color<=100, e.g. when DATC[0]=0x37, it means Color=55.
SetAud0Vol	0xC8	DATC[0] DATC[1]	0xC8	DATA[0]	Set up the volume of current audio channel 0. 1) DATC[0]=0x00, represents channel 0; 2) DATA[0]=0x00, represents channel 0; 3) DATC[1]=Audio0Volume, 0<= Audio0Volume <=100, e.g. when DATA[1]=0x37, it means Audio0Volume=55.
SetAud1Vol	0xC8	DATC[0] DATC[1]	0xC8	DATA[0]	Set up the volume of current audio channel 1. 1) DATC[0]=0x01, represents channel 1; 2) DATA[0]=0x01, represents channel 1; 3) DATC[1]=Audio1Volume, 0<= Audio1Volume <=100, e.g. when DATC[1]=0x37, it means Audio0Volume =55.
SetOSDOnoff	0xC7	DATC[0]	0xC7	None	Open or close OSD 1) DATC[0]=0x00, OSD is open. OSD displays operating information of MPD. 2) DATC[0]=0x01, OSD is closed; 3) DATC[0]=0x02, OSD is in automatic mode. When MPD finds some info change, it automatically opens OSD, and display the change info on the OSD. When the info keeps stable for about 10 seconds, the OSD is then automatically closed.
SetOSDTnsp	0xC6	DATC[0]	0xC6	None	Set up OSD transparency. 1) DATC[1]=0x00, set OSD transparency as 0%; 2) DATC[1]=0x01, set OSD transparency as 20%; 3) DATC[1]=0x02, set OSD transparency as 40%; 4) DATC[1]=0x03, set OSD transparency as 60%; 5) DATC[1]=0x04, set OSD transparency as 80%. 6) Note: this command will keep OSD and LOGO of MPD in open status.

SetOSDPosX	0xC5	DATC[0]	0xC5	DATA[0]	Set up OSD horizontal position. 1) DATC[0]=0x01, it means to horizontally move the OSD window to the right by one unit (2 pixels) . 2) DATC[0]=0x00, it means to horizontally move the OSD window to the left by one unit (2 pixels). 3) DATA[0]= xPos(0<=xPos<=120). xPos refers to the current OSD horizontal offset. When xPos reaches its limit, this command will not further increase or decrease the OSD horizontal offset. 4) Note: this command will keep OSD and LOGO of MPD in open status.
SetOSDPosY	0xC4	DATC[0]	0xC4	DATA[0]	Set up OSD vertical position. 1) DATC[0]=0x01, it means to vertically move OSD window downward by one unit (2 lines); 2) DATC[0]=0x00, it means to vertically move OSD window upward by one unit (2 lines); 3) DATA[0]= yPos(160<=yPos<=200). yPos refers to the current OSD vertical offset. When yPos reaches its limit, this command will not further increase or decrease the OSD vertical offset. 4) Note: this command will keep OSD and LOGO of MPD in open status.
LogoOnoff	0xC3	DATC[0]	0xC3	None	Open or close Logo。 1) DATC[0] = 0x00, Logo is open; 2) DATC[0] = 0x01, Logo is closed. 3) Note: the relative position of logo and OSD is fixed, so the commands of SetOSDPosX and SetOSDPosY will also influence the position of the Logo. As Logo's transparency consists with that of OSD, the command of SetOSDTnsp also influence Logo's transparency.
PresetPara	0xC2	None	0xC2	None	Restore default parameters. 1) When MPD sends out acknowledge frame, it only means that MPD has received this command, and the actual restore of all the parameters will happen in 20 seconds. 2) This command will cause the re-start of MPD system. Host should then sends out several LinkTest command until MPD's LinkTest acknowledges, which means that MPD has completed the re-start and has restored all the default settings.

WriteTxt					TBD.

Warning

Warning frame is the warning message that MPD initiatively sends out to the monitoring program. There are two cases, one is wrong command report, and the other is operation status report. The monitoring program does not need to send out acknowledge frame in both cases.

Wrong command report

When MPD sends out wrong command report, it means that MPD has received a non-analysable report from the monitoring frame. The definitions of related bit field in the wrong command report are as follows:

LENH=0x00, LENL=0x02: means its data segment length is 1 byte.
WARN=0x22: means it is a warning frame.
DATA[0]=0xBD: means it is a wrong command report.

Operation Status Report

When MPD tests any status change, it will initiatively send out corresponding report to the monitoring program. The definitions of related bit field in the operation status report are as follows:

LENH=0x00, LENL=0x05: means its data segment length is 4 bytes.
WARN=0x22: means it is a warning frame.
DATA[0..3]: forms a 4-byte status change bit field. Please refer to the Table below for its definition.

Status change bit field

DATA[3]			**DATA[2]**			
Bit31..24			Bit23..19	Bit18	Bit17	Bit16
RES			RES	AUD1	AUD0	VID
DATA[1]			**DATA[0]**			
Bit15..10	Bit9	Bit8	Bit7..3	Bit2	Bit1	Bit0
RES	PSI	TS	RES	AS	PL	TVMD

1) RES is always 0;
2) If some bit is 1, it means the corresponding status changes; if it is 0, it means the corresponding status has not changed.
3) TVMD: Format of analog video output;
4) PL: Syntax byte and level of digital video;
5) AS：Audio sampling rate;
6) TS：Bit stream status of ASI input;
7) PSI：Bit stream PSI information;
8) VID：video decode module abnormal;
9) AUD0：Audio channel 0 decode abnormal;
10) AUD1: Audio channel 1 decode abnormal.

Handshake Acknowledge Time Order

Handshake Acknowledge rules is given as:

- Expect for warning, MPD does not initiatively send out acknowledge data frame, and only when Host sends out one command, MPD replies with one acknowledge data frame;
- Host should send out commands at an interval of more than 50ms;

- Within the same command, the bytes should be consecutive with interval of less than 1ms;
- After sending out one command, Host should wait for the acknowledgement (or time-out) before sending out another command.

MPD Serial Port Communication Protocol - Quick reference

Meeting the serial port communication protocol v1.0, the form of serial data frame is defined as:

HEAD(BYTE) + ID(WORD)+LEN (WORD)+COM (BYTE)+ SUM

System Operation：

Cmd	Data format show as HEX form	Comment
LinkTest	AA 00 00 00 01 FF 00 55	
SoftVer	AA 00 00 00 01 FE FF 55	
GetID	AA 00 00 00 01 FB FC 55	
SetID	AA 00 00 00 03 FA 00 1D 1A 55	
SysRst	AA 00 00 00 01 FD FE 55	
AsiInput	AA 00 00 00 01 FC FD 55	

Monitor Operation：

Cmd	Data format show as HEX form	Comment
TvMode	AA 00 00 00 01 EF F0 55	
VideoSpec	AA 00 00 00 01 EE EF 55	
AudioSamp	AA 00 00 00 01 ED EE 55	
VideoPID	AA 00 00 00 01 EC ED 55	
AudioPID	AA 00 00 00 02 EB 00 ED 55	
SelProg	AA 00 00 00 01 EA EB 55	
Bright	AA 00 00 00 01 E9 EA 55	
Contrast	AA 00 00 00 01 E8 E9 55	
Hue	AA 00 00 00 01 E7 E8 55	
Color	AA 00 00 00 01 E6 E7 55	
AudioVolume	AA 00 00 00 02 E5 01 EA 55	
OsdStatus	AA 00 00 00 01 E4 E5 55	
DecStatus	AA 00 00 00 01 E3 E6 55	
PsiInfo	AA 00 00 00 01 E2 E3 55	

Control Operation：

SetVidPID	AA 00 00 00 03 CF 00 C8 9A 55	
SetAudPID	AA 00 00 00 04 CE 00 00 C9 9B 55	
SetProgNo	AA 00 00 00 03 CD 00 01 D1 55	
Set_Bright	AA 00 00 00 02 CC 00 CE 55	// 0
	AA 00 00 00 02 CC 64 32 55	//100
Set_Contrast	AA 00 00 00 02 CB 0A D7 55	// 10
	AA 00 00 00 02 CB 5A 27 55	// 90
Set_Hue	AA 00 00 00 02 CA 00 CC 55	// 0
	AA 00 00 00 02 CA 64 30 55	//100
Set_Color	AA 00 00 00 02 C9 00 CB 55	// 0
	AA 00 00 00 02 C9 64 2F 55	//100
SetAudVol	AA 00 00 00 03 C8 00 00 CB 55	// ch0 :0
	AA 00 00 00 03 C8 00 64 2F 55	// ch0 :100
SetOSDOnoff	AA 00 00 00 02 C7 00 C9 55	//open
	AA 00 00 00 02 C7 02 CB 55	//auto
	AA 00 00 00 02 C7 01 CA 55	//close
SetLogoOnoff	AA 00 00 00 02 C3 00 C5 55	//open
	AA 00 00 00 02 C3 01 C6 55	//close
SetOsdTnsp	AA 00 00 00 02 C6 00 C8 55	// 00%
	AA 00 00 00 02 C6 01 C9 55	// 25%
	AA 00 00 00 02 C6 02 CA 55	// 50%
	AA 00 00 00 02 C6 03 CB 55	// 75%
SetOsdPosY	AA 00 00 00 02 C4 01 C7 55	// down
	AA 00 00 00 02 C4 00 C6 55	// up
SetOsdPosX	AA 00 00 00 02 C5 01 C8 55	// right
	AA 00 00 00 02 C5 00 C7 55	// left
SetPrepara	AA 00 00 00 01 C2 C3 55	

Get MPEG-2 Program Specs Information

After running PsiInfo (command listED in ***Monitor Operation***), you will get a group of acknowledge data as follows:

```
AA  00 00  01 59  E3

07 CB  //transfer id
00 06  //progNum

//prog0:
00 01  00 80  00 64  00 02
00 64  00 02
00 65  00 04
52 6F 68 64 65 20 26 20 53 63 68 77 61 72 7A 00 00 00 00 00
42 6F 75 6E 63 65 00 00 00 00 00 00 00 00 00 00 00 00 00 00

//prog1:
00 02  00 81  00 C8  00 03
00 C8  00 02
00 C9  00 04
00 CA  00 04
52 6F 68 64 65 20 26 20 53 63 68 77 61 72 7A 00 00 00 00 00
48 2D 53 77 65 65 70 20 31 00 00 00 00 00 00 00 00 00 00 00

//prog2:
00 03  00 82  01 2C  00 02
01 2C  00 02
01 2D  00 04
52 6F 68 64 65 20 26 20 53 63 68 77 61 72 7A 00 00 00 00 00
52 61 6D 70 20 59 20 43 00 00 00 00 00 00 00 00 00 00 00 00

//prog3:
00 04  00 83  01 90  00 02
01 90  00 02
01 91  00 04
52 6F 68 64 65 20 26 20 53 63 68 77 61 72 7A 00 00 00 00 00
4E 6F 6E 6C 69 6E 65 61 72 69 74 79 00 00 00 00 00 00 00 00

//prog4:
00 05  00 84  01 F4  00 02
01 F4  00 02
01 F5  00 04
52 6F 68 64 65 20 26 20 53 63 68 77 61 72 7A 00 00 00 00 00
52 47 42 20 53 77 65 65 70 00 00 00 00 00 00 00 00 00 00 00

//prog5:
00 06  00 85  02 58  00 02
02 58  00 02
02 59  00 04
52 6F 68 64 65 20 26 20 53 63 68 77 61 72 7A 00 00 00 00 00
43 43 49 52 31 37 00 00 00 00 00 00 00 00 00 00 00 00 00 00

BB 55
```

Then, transform these data from HEX to ASCII form. PSI information is shown as:

```
PSI_INFO: TotProgNum=6
Porg0,PidNum=2: PmtId=0001 PmtPid=0080 PcrPid=0064
  Type:0002, PID=0x0064
  Type:0004, PID=0x0065
Provider: Rohde & Schwarz
ProgName: Bounce
Porg1,PidNum=3: PmtId=0002 PmtPid=0081 PcrPid=00C8
  Type:0002, PID=0x00C8
  Type:0004, PID=0x00C9
  Type:0004, PID=0x00CA
Provider: Rohde & Schwarz
ProgName: H-Sweep 1
Porg2,PidNum=2: PmtId=0003 PmtPid=0082 PcrPid=012C
  Type:0002, PID=0x012C
  Type:0004, PID=0x012D
Provider: Rohde & Schwarz
ProgName: Ramp Y C
Porg3,PidNum=2: PmtId=0004 PmtPid=0083 PcrPid=0190
  Type:0002, PID=0x0190
  Type:0004, PID=0x0191
Provider: Rohde & Schwarz
ProgName: Nonlinearity
Porg4,PidNum=2: PmtId=0005 PmtPid=0084 PcrPid=01F4
  Type:0002, PID=0x01F4
  Type:0004, PID=0x01F5
Provider: Rohde & Schwarz
ProgName: RGB Sweep
Porg5,PidNum=2: PmtId=0006 PmtPid=0085 PcrPid=0258
  Type:0002, PID=0x0258
  Type:0004, PID=0x0259
Provider: Rohde & Schwarz
ProgName: CCIR17
```